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Forest Insect & Disease Leaflet 161

U.S. Department of Agriculture Forest Service

Diplodia Blight of Pines

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The fungus *Diplodia pinea* (Desm.) Kickx is most damaging to plantings of both exotic and native pine species in the United States. The fungus is seldom found in natural pine stands. *Diplodia pinea* kills current-year shoots, major branches, and ultimately entire trees. The effects of this disease are most severe in landscape, windbreak, and park plantings in the Central and Eastern United States.

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Distribution

Diplodia pinea is known to occur in 30 Eastern and Central States and in Hawaii and California (fig. 1). The fungus infects more than 20 pine species. It is commonly found on Austrian pine, which, since the early 1900's, has been widely used in the Central and Eastern United States in landscape, windbreak, and park plantings. Damage by *D. pinea* is frequently reported on Scots (*P. sylvestris* L.), red (*P. resinosa* Ait.), ponderosa (*P. ponderosa* Laws.), and Mugo (*P. mugo* Turra) pines in the United States. *D. pinea* infects Monterey pine (*P. radiata* D. Don) in California and has seriously damaged extensive plantings of this species in the Southern Hemisphere (New Zealand, Australia, South Africa).

Symptoms and Damage

The most conspicuous symptom of diplodia blight is brown, stunted new shoots with short, brown needles (fig. 2). Needles on infected new shoots often become

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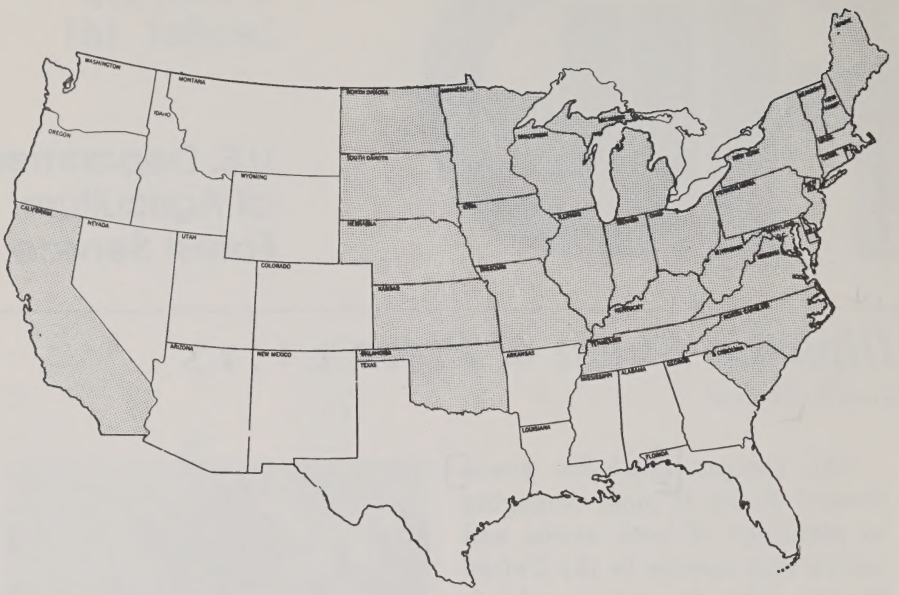

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Figure 1.—States in which *D. pinea* is present.

discolored (tan, brown) while still encased in fascicle sheaths. Presence of resin droplets and one or a few very short needles are usually the first indications that a new shoot is infected (fig. 3). Entire new shoots are killed rapidly by the fungus. Trees repeatedly infected have some branches killed back to the main stem. Repeated infections reduce growth, deform trees, and ultimately kill them.

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Figure 2.—Infection of new shoots of Austrian pine.

New shoots throughout the crown may be infected, although damage is generally first evident in the lower crown. Usually infection varies considerably among major banches. Occasionally, after 2 or 3 successive years of infection, tree tops are extensively damaged (fig. 4).

Although pines of all ages are susceptible to *D. pinea*, damage is more severe in older plantings. In Great Plains windbreaks that were 20 to 22 years old, only a few pines were infected by *D. pinea;* but incidence and damage increased as the trees approached 30 years of age.

Damage may be confined to the new shoots, particularly on trees

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Figure 3.—Austrian pine shoot with early symptoms of diplodia blight; one very short needle with resin droplet.

with shoots infected for the first time. The fungus will infect older stem tissues, but the way this occurs is not always evident. Commonly, when new shoots are killed, only a small percentage of the subtended stem tissue and second-year needles show evidence of infection. On severely damaged trees, however, the fungus usually can be isolated from all segments of major branches.

Although unwounded new shoots can be infected, *D. pinea* can infect both current-year and older tissues through wounds. In the Southern Hemisphere, *D. pinea* has often severely damaged trees wounded by hail. Also, damage by *D. pinea* has been associated with wounds made by insects. Tissues wounded during pruning or shearing operations may become infected. Wounded tissues remain vulnerable to *D. pinea* infection for several days. Stems of Austrian, Scots, and ponderosa pines wounded in May and late June were vulnerable to infection for at least 12 days after wounding.

Seed cones of Austrian, ponderosa, and Scots pines are susceptible to *D. pinea* their second year, but not the first.

Disease Cycle

Small, black fruiting bodies (pycnidia), in which *D. pinea* spores develop, form on needles, fascicle sheaths, scales of second-year seed cones, and bark. The fruiting bodies can be seen with a

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Figure 4.—Austrian pine with top killed by *D. pinea*.

10X hand lens. These black bodies, which erupt through the epidermis, usually are numerous at the base of needles (fig. 5) and on scales of second-year seed cones (fig. 6). Fruiting bodies are easily found on short needles of shoots infected the previous year, particularly on those that have turned ashen-gray and are easy to detach. When rainfall is above normal in late summer, unusually high numbers of pycnidia may develop on current-year needles and second-year cones. In most years, however, pycnidia are not numerous on these needles and cones until the following spring.

Spores are dispersed from March to October. The spores are transparent at first and later become brown (fig. 7). Accurate identification of the fungus is difficult because the genus *Diplodia* is described as having brown, one-septate spores; however, *D. pinea* pycnidia may yield many spores without any cross walls (septa). The percentage of spores with cross walls was very low (less than 1 percent) in pycnidia collected early and late in the growing season from fascicle sheaths, cone scales, and needles of Austrian and Scots pines in the Central United States.

Highly moist conditions are needed for infection. Large numbers of spores are dispersed only during rainy periods and high relative humidities are required for spores to germinate and for germ tubes to grow and penetrate needles and shoots. If there is little rain when new shoots are highly susceptible, infection levels usually are very low. Once the fungus penetrates needles, tissues are rapidly destroyed, resulting in stunted shoots and needles.

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Figure 5.—Pycnidia of *D. pinea* erupting through epidermis at needle base.

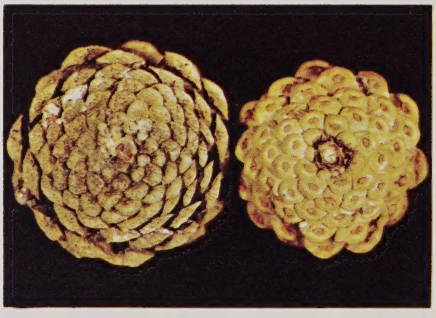

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Figure 6.—Pycnidia of *D. pinea* on cone (left); noninfected cone (right).

New shoots of Austrian, ponderosa, and Scots pines are most susceptible during a 2-week period starting when buds begin to open and continue to be susceptible until about mid-June. Growth of new shoots, needles, and seed cones with respect to the period of high susceptibility is shown in figure 8. Symptoms on new shoots can readily be detected in late May; extent of infection can be effectively determined in late June or July.

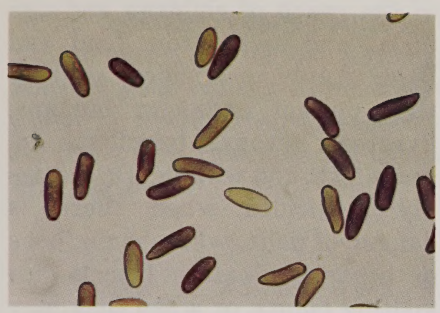

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Figure 7.—Spores of *D. pinea.*

Second-year seed cones are initially infected in late May. Numerous fruiting bodies develop on infected second-year cones and the increased damage to older trees is probably related to this fungus buildup. Infected seed cones often are observed on otherwise healthy pines, which indicates that, on older pines, inoculum builds up on seed cones before new shoots are extensively infected.

Control

Infection of new shoots can be reduced significantly by applying fungicide to pines during the 2-week period when shoots are highly susceptible to infection. This period, approximately from April 24 to May 8 in eastern Nebraska for example, begins with the opening of buds. During this short period, two applications of 4-4-50 Bordeaux mixture [4 lb. (1.8 kg) copper sulfate, 4 lb. (1.8 kg) hydrated lime, and 50 gal. (189 l) water] approximately 1 week apart are more effective than one application.

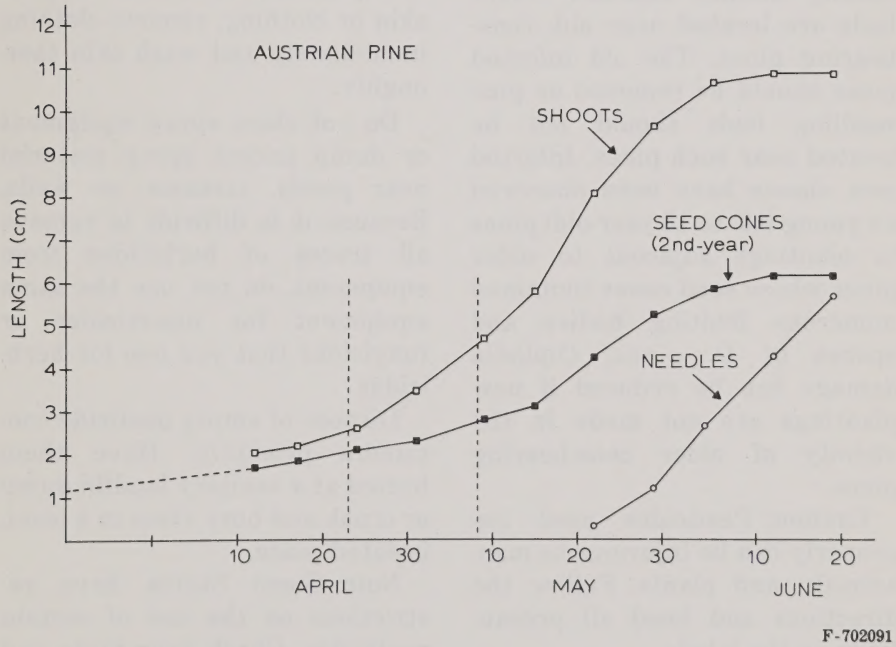

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Figure 8.—Growth of shoots, needles, and seed cones of Austrian pine in relation to period of high susceptibility (broken vertical lines) of new shoots to *D. pinea* in eastern Nebraska.

Fungicide applied during late April and early May to protect new shoots does not prevent infection of seed cones. Thus it would probably not be practical to try to reduce inoculum (spores) on seed cones with protective fungicides, since one or more additional fungicide applications would be required. Removal of infected branches may be justified on the basis of improving tree appearance, but this procedure probably would not reduce the amount of infection significantly.

Pruning or shearing in Christmas tree or other pine plantings should be avoided during periods when conditions are highly favorable for infection because of danger of infection through wounds.

Pine seedlings in nursery beds usually become infected where beds are located near old, cone-bearing pines. The old infected pines should be removed or pine seedling beds should not be located near such pines. Infected new shoots have been observed on young (10- to 15-year-old) pines in plantings adjacent to older pines whose seed cones contained numerous fruiting bodies and spores of *D. pinea.* Diplodia damage can be reduced if new plantings are not made in the vicinity of older cone-bearing pines.

Caution: Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed. Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or when they may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump or crush and bury them in a level, isolated place.

Note: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are

under constant review by the Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure the intended use is still registered.

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January 1981

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